

Measuring Competitiveness: Trade in Goods or Tasks?

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Background

- Global Value Chains (GVCs) have important implications for measures of competitiveness, namely the real effective exchange rate (REER).
 - The standard REER (Armington, 1969; McGuirk, 1987; Bayoumi and others, 2005) computed at the Fund is based on the assumption that goods traded are *final* goods only.
- Given that trade in *intermediate* goods is now more than two thirds of total trade, this may be problematic.
 - Changes in exchange rate are more complex.
 - e.g., a nominal appreciation makes goods more expensive to export, but also intermediate inputs cheaper to import.

- One approach: move away from a “goods” to “value-added” world
 - Measure competitiveness of “factors of production” rather than “goods”
 - Value-Added Real Effective Exchange Rates, VAREER (Bems and Johnson, 2012)
- An alternative approach: within a “goods” world, modify the formula to reflect changes in intermediate input costs
 - Continue to measure competitiveness of “goods”
 - Integrated Effective Exchange Rate, IEER (Thorbecke, 2011; Unteroberdoerster and others, 2011)
 - Goods Real Effective Exchange Rates, GOREER (Bayoumi, Saito, Turunen, 2013)

Model

- The Armington model

- Consumer in country j :

$$\begin{aligned} & \text{Max } U(C_{1j}, \dots, C_{nj}) \\ & \text{s.t. } \bar{Y}_j = P_1 C_{1j} + \dots + P_n C_{nj}. \end{aligned}$$

- Standard REER:

$$REER_j^{Standard} = \prod_{k \neq j} \left(\frac{P_j R_j}{P_k R_k} \right)^{w_{jk}}$$

where P_j : price of goods; R_j : exchange rate; w_{jk} : gross trade weights.

- There is neither production sharing nor intermediate inputs trade.

- Specify production technology to derive intermediate input demand.

- Producer in country j :

$$\begin{aligned} \text{Min } C(w_j, r_j, P_1, \dots, P_n; X_j) &= w_j L_j + r_j K_j + P_1 X_{1j} + \dots + P_n X_{nj} \\ \text{s.t. } X_j &= F(L_j, K_j, X_{1j}, \dots, X_{nj}). \end{aligned}$$

- Once technology is specified, the price of goods can be derived: $P_j = P_j(w_j, r_j, P_1, \dots, P_n)$.
- But the price function as a function of prices of all goods is not very helpful in calculating REER!

- Notice that the cost function can equivalently be expressed as the sum of cost of all factors embedded in goods:

$$\begin{aligned} \text{Total Cost} &= w_j L_j + r_j K_j + \sum_i P_i X_{ij} \\ &= q_j D_j + \sum_{i \neq j} q_i M_{ij}, \end{aligned}$$

where q_j : price of factors; D_j : domestic factors (or value added); M_{ij} : foreign country i 's factors (or value added) embedded in country j 's goods.

- The price of goods can be expressed as a function of prices of production factors of all countries: $P_j = P_j(q_1, \dots, q_n)$.

- Producer in country j :

$$\text{Min } C(q_j, q_1, \dots; \bar{X}_j) = q_j D_j + \sum_{i \neq j} q_i M_{ij}$$

$$\text{s. t. } \bar{X}_j = \left(\delta_j D_j^{\frac{\sigma_j - 1}{\sigma_j}} + (1 - \delta_j) M_j^{\frac{\sigma_j - 1}{\sigma_j}} \right)^{\frac{\sigma_j}{\sigma_j - 1}} \quad \text{and } M_j = \left(\sum_{j \neq i} \varphi_{ij} M_{ij}^{\frac{\sigma_j^M - 1}{\sigma_j^M}} \right)^{\frac{\sigma_j^M}{\sigma_j^M - 1}} .$$

D_j : domestic value added in j

M_{ij} : foreign value added from i used in j

q_i and q_j : cost of value added in i and j

σ_j : elasticity of substitution between D_j and M_j

σ_j^M : elasticity of substitution among M_{ij}

- Cost function:

$$C(q_j, q_1, \dots; \bar{X}_j) = \left(\delta_j^{\sigma_j} q_j^{(1-\sigma_j)} + (1 - \delta_j)^{\sigma_j} q_j^M{}^{(1-\sigma_j)} \right)^{\frac{1}{1-\sigma_j}} \cdot \bar{X}_j,$$

$$\text{where } q_j^M = \left(\sum_{i \neq j} \varphi_{ij}^{\sigma_j^M} q_i^{(1-\sigma_j^M)} \right)^{\frac{1}{1-\sigma_j^M}}.$$

- Price of output:

$$P_j = \left(\delta_j^{\sigma_j} q_j^{(1-\sigma_j)} + (1 - \delta_j)^{\sigma_j} q_j^M{}^{(1-\sigma_j)} \right)^{\frac{1}{1-\sigma_j}}.$$

- One approach:
 - compute the price of output and replace it with the CPI index currently used.
 - Drawback: no consensus on elasticities.
- Alternative approach:
 - assume a Cobb-Douglas functional form ($\sigma_j = \sigma_j^M \rightarrow 1$)
 - Price of output:

$$P_j = c_j \cdot q_j^{\delta_j} q_j^{M(1-\delta_j)} = c_j \cdot q_j^{\delta_j} \left(\prod_{i \neq j} q_i^{\phi_{ij}} \right)^{(1-\delta_j)}$$

δ_j : domestic value added cost share in total cost;

ϕ_{ij} : share of cost of country i 's factors in total cost of imported factors (or value added);

c_j : constant term.

- GOREER

$$REER_j^{Goods} = \prod_{k \neq j} \left(\frac{q_j R_j}{q_k R_k} \right)^{w_{jk}} \prod_{k \neq j} \left(\frac{c_j \prod_{i \neq j} \left(\frac{q_j R_j}{q_i R_i} \right)^{-\varphi_{ij}(1-\delta_j)}}{c_k \prod_{i \neq k} \left(\frac{q_k R_k}{q_i R_i} \right)^{-\varphi_{ik}(1-\delta_k)}} \right)^{w_{jk}},$$

- No production sharing case, $\delta_k = \delta_j = 1$

$$REER_j = \prod_{k \neq j} \left(\frac{P_j R_j}{P_k R_k} \right)^{w_{jk}} = \prod_{k \neq j} \left(\frac{q_j R_j}{q_k R_k} \right)^{w_{jk}}$$

- No production sharing in partner countries, $\delta_k=1$

$$REER_j = \prod_{k \neq j} \left(\frac{P_j R_j}{P_k R_k} \right)^{w_{jk}} = c_j \prod_{i \neq j} \left(\frac{q_j R_j}{q_i R_i} \right)^{-\varphi_{ij}(1-\delta_j)} \prod_{k \neq j} \left(\frac{q_j R_j}{q_k R_k} \right)^{w_{jk}}.$$

Empirical Application

Standard REER vs. Two Alternatives

- Standard REER: $REER_j^{Standard} = \prod_{k \neq j} \left(\frac{P_j R_j}{P_k R_k} \right)^{w_{jk}}$
 - P_j : price of goods; R_j : exchange rate; w_{jk} : gross trade weights.
- REER in “Tasks”: $REER_j^{Tasks} = \prod_{k \neq j} \left(\frac{q_j R_j}{q_k R_k} \right)^{v_{jk}}$
 - q_j : price of production factors; v_{jk} : value-added trade weights.
- REER in “Goods”: $REER_j^{Goods} = \prod_{k \neq j} \left(\frac{q_j R_j}{q_k R_k} \right)^{w_{jk}} \prod_{k \neq j} \left(\frac{q_j R_j}{q_k R_k} \right)^{\omega_{jk}}$
 - one capturing competitiveness of domestic value-added (DVA) part of gross exports and the other foreign value-added (FVA) part.
 - ω_{jk} captures relative importance of FVA vis-à-vis DVA as well as relative importance among source countries comprising FVA.

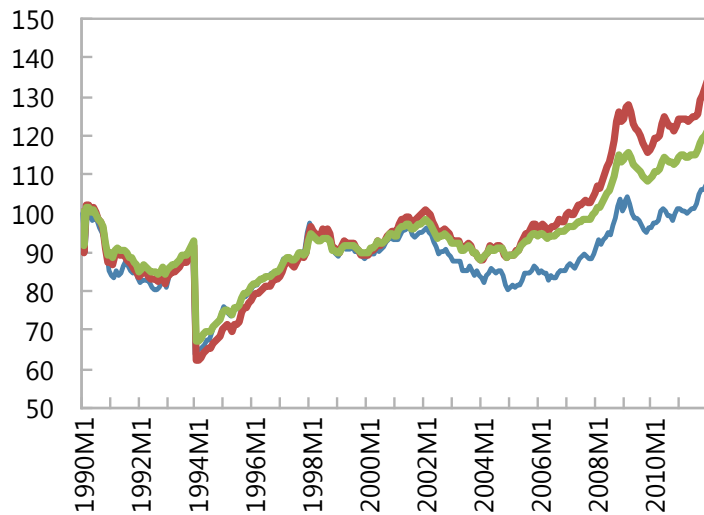
Standard vs. Two Alternatives

- Price indices
 - Standard REER uses the CPI (consistent with the assumption that only final goods are traded).
 - Two alternatives use the GDP deflators to capture the price of factors of production (labor and capital).
 - Caveat in using the GDP deflators (e.g., frequency, transfer pricing)
- Trade weights
 - Standard REER uses gross trade weights (captures competition in home, foreign and other markets)
 - Two alternatives use value-added trade weights
- The choice of price indices matters more.

A Comparison between Standard REER and Two Alternatives

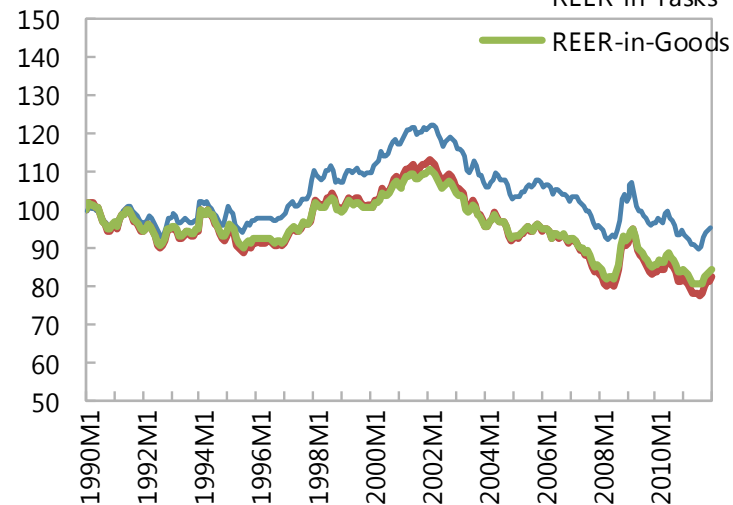
China

(Index, 1990M1 = 100)



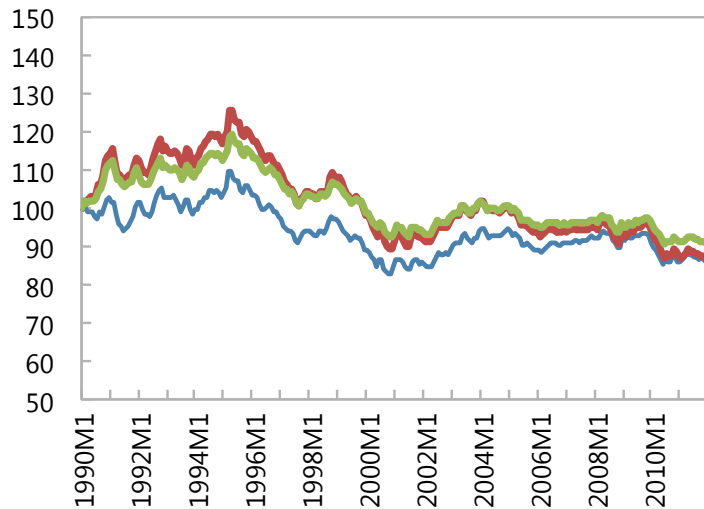
United States

(Index, 1990M1 = 100)



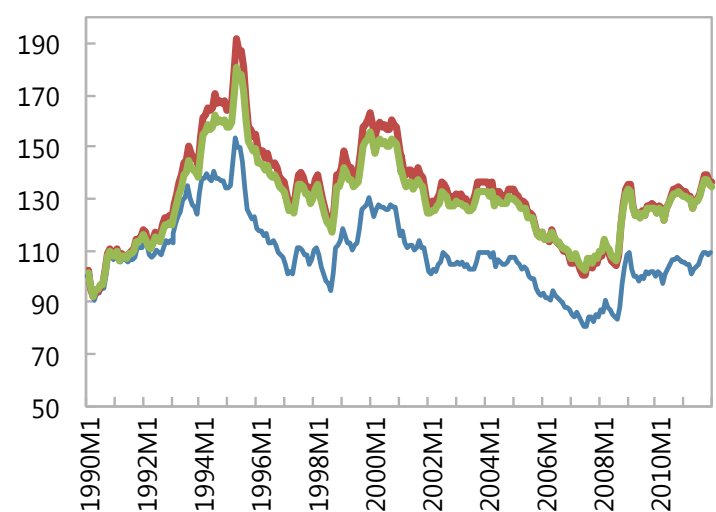
Germany

(Index, 1990M1 = 100)



Japan

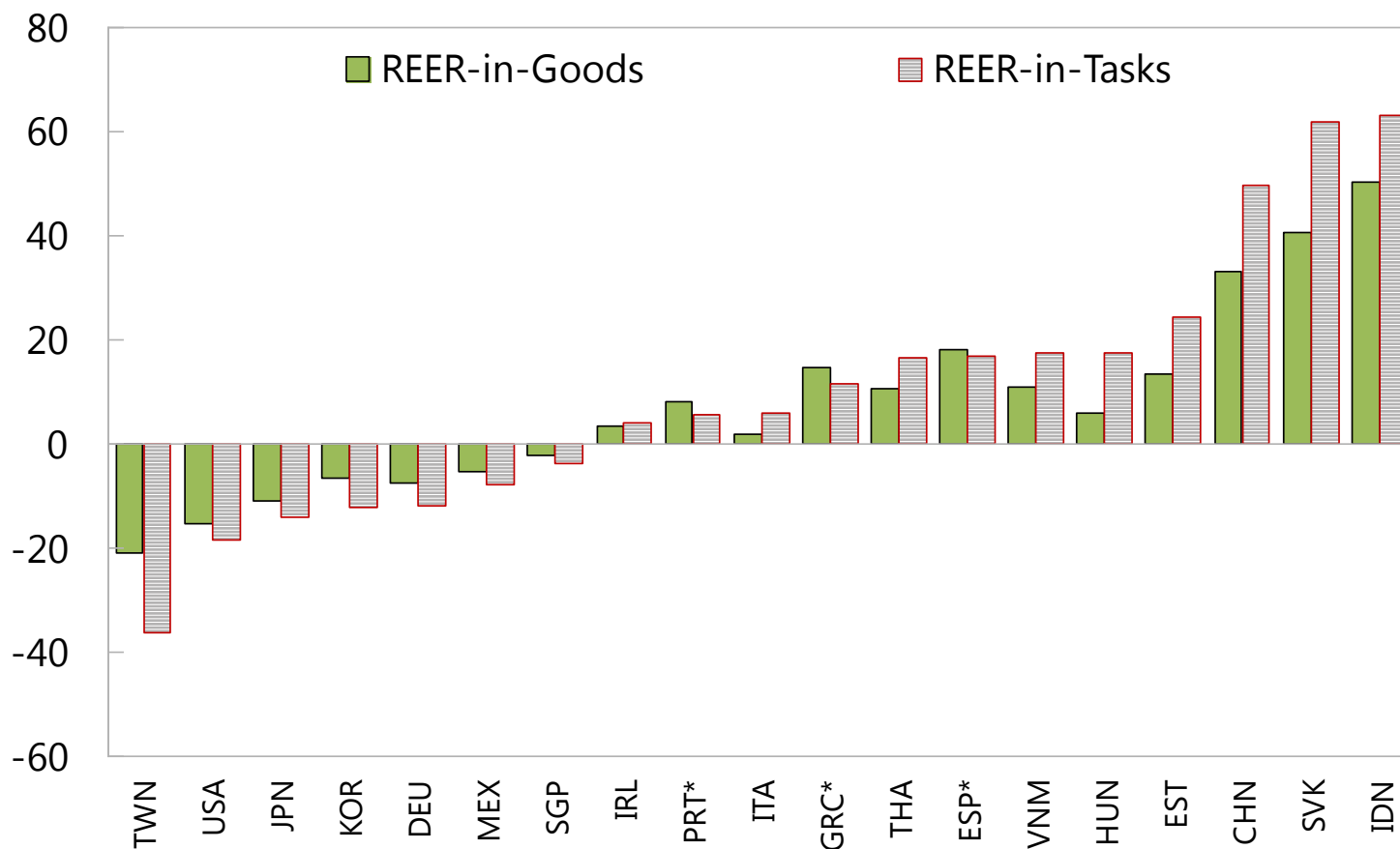
(Index, 1990M1 = 100)



Important differences for emerging market economies

Changes in REER-in-Tasks and in REER-in-Goods

(cumulative percentage change, 2000-11)



Sources: OECD, Fund staff estimates.

Summary

- Main Findings:
 - Incorporating GVCs in measures of the REER provides new insights on competitiveness.
 - Differences between the rate of change in relative prices of goods and that in relative factor prices are typically small. For emerging market economies with larger roles of outsourcing, however, differences are larger.
- Policy Implications:
 - It is useful to monitor REERs computed using alternative price measures.
 - Further work on measurement and the applicability of these indices is however needed to operationalize these indices fully.

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